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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/759,854	01/12/2001	Christopher Ngai	A4467/T3500	1861
32588	7590	10/16/2003	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			BREWSTER, WILLIAM M	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 10/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/759,854	NGAI ET AL.	
	Examiner	Art Unit	
	William M. Brewster	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 15-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18 is/are allowed.
- 6) ☒ Claim(s) 1-13 and 15-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>70203</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-13, 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singh, et al., 6,191,046 B1, in view of Lai et al., U.S. Patent No. 6,136,680.

Singh teaches in fig. 1A, a method for depositing a layer on a substrate 20 having a barrier layer 25 in a process chamber, col. 4, lines 1-53, the method comprising: supplying a gaseous mixture to the process chamber, the gaseous mixture comprising a silicon-containing gas, TEOS, a fluorine-containing gas, SiF₄, an oxygen-containing gas, O₂, and a nitrogen-containing gas, N₂; and providing energy to the gaseous mixture to deposit a nitrogen-containing fluorinated silicate glass layer onto the barrier layer, a PECVD method, wherein inherently some the nitrogen in the plasma reaction would combine with the other reactants to form nitrogen containing fluorinated silicate glass, col. 5, lines 37-43.

Singh does not teach forming a copper metal layer over a Ta or TaN barrier layer over the NFSG, but Lai does. Lai teaches a method for depositing a layer on a substrate having a barrier layer in a process chamber, the method comprising: in fig. 1,

forming a substrate 10, a metal layer, 12, a barrier layer 14 over the metal layer, col. 5, line 58 - col. 6, line 18;

limitations from claim 16-17: wherein by constructive notice the metal layer is copper as is cross-hatched the same as copper layer 24 in fig. 3, col. 6, lines 42-48, in fig. 2 forming a fluorinated silicate glass layer 16 on the barrier layer, creating nitrogen-containing fluorinated silicate glass, col. 8, lines 1-15, patterning with a photoresist, in fig. 3, forming a barrier layer 20 over the nitrogen-containing fluorinated glass 16,

limitations from claims 2-4: where the barrier layer is comprised of tantalum nitride, forming metal over the barrier layer 24, where the metal layer is copper, col. 6, lines 28-49.

Lai gives motivation in col. 4, lines 8-13. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to recognize that combining Lai's process with Singh's invention would have been beneficial because it provides an improved method of forming metal interconnects.

For claims 9-14, neither Singh nor Lai does not specify the flow rate of nitrogen or the atomic % of nitrogen in the fluorinated silicate glass layer. It follows that since the plasma ashing procedure uses nitrogen, some, but not much would diffuse into the fluorinated silicate glass layer, reasonably 0.03-0.08 at. % of nitrogen could be achieved. Even if Lai does not teach this, the numbers may be optimized.

“Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art . . . such ranges are termed ‘critical ranges’ and the applicant has the burden of proving such criticality . . . More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”

In re Aller 105 USPQ 233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Allowable Subject Matter

Claims 18-28 allowed.

In claim 18, the limitations of lines 7-9, "removing the photoresist layer and substantially simultaneously introducing nitrogen dopants into the fluorinated silicate glass layer by subjecting the photoresist layer and the fluorinated silicate glass layer to a plasma formed from a nitrogen-containing gas; wherein the plasma contains no oxygen species" can not be found in the prior art of record.

Response to Arguments

Applicant's arguments filed 11 September 2003 have been fully considered but they are not persuasive. Applicant argues that Singh does not produce a nitrogen-containing fluorinated silicate glass. Examiner disagrees. While examiner concedes that Singh does not state that his FSG contains nitrogen, the reactant gases and the PECVD mirror those of the application. With the same reactants and processing, the same material, nitrogen-containing fluorinated silicate glass would result.

Applicant's arguments with respect to Lin have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William M. Brewster whose telephone number is 703-305-5906. The examiner can normally be reached on Full Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3432 for regular communications and 703-305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

WB
October 2, 2003


W. DAVID COLEMAN
PRIMARY EXAMINER